Verification of an Automated Faecal Elastase Assay for Use in NHS Lanarkshire

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Introduction

Pancreatic exocrine insufficiency (PEI) refers to the impaired secretion or activity of pancreatic enzymes, preventing the digestion of carbohydrates, fats and protein[1]. Long term, PEI may lead to malnutrition, osteoporosis and sarcopenia[1,3]. PEI is considered an underdiagnosed and undertreated condition[2], presenting with non-specific symptoms, including weight loss, abdominal pain, steatorrhoea, and bloating which negatively impact on quality of life[3].

PEI is diagnosed through the measurement of elastase (Fe-1) in stool samples. Elastase is a pancreatic protease which is resistant to degradation in transit through the gastrointestinal tract, being excreted in stool.

The concentration of Fe-1 reflects pancreatic exocrine function, correlating well with both the output of other pancreatic enzymes and more sensitive tests of pancreatic function[4].

Currently in NHS Lanarkshire, samples for Fe-1 measurement are sent to NHS Lothian and analysed using the ScheBo® PE1 stool test, with an estimated turnaround time of 10 days. As NHS Lanarkshire currently uses the Alpha Laboratories CALEX® cap devices to measure faecal calprotectin (FCal), this project explored the possibility of using the Alpha Laboratories BÜHLMANN fPELA assay and CALEX® cap devices for the measurement of Fe-1 in NHS Lanarkshire.

Aims

- Determine what proportion of patients receive testing for both Fe-1 and FCal, plus how many requests for Fe-1 are rejected and the reasons why.
- Verify the Alpha Laboratories BÜHLMANN fPELA assay for the measurement of Fe-1 for use in NHS Lanarkshire.

Methods

A service review was performed using NHS Lanarkshire LIMS to the number of Fe-1 rejections and the reasons for these rejections from January 2023 – June 2024.

The BÜHLMANN fPELA assay was verified through assessment of accuracy and precision, limit of blank, limit of detection, linearity, a patient comparison with the ScheBo® PE1 assay (n = 42), comparison with EQA material and a stability study of samples in CALEX® cap devices.

Results

Service Review

The review found that 15% (199 of 1,382) of Fe-1 requests in the review period were rejected, the prevailing reasons for which were samples not being received or inappropriate sample types. In addition, 58% (799 of 1,382) of patients in Lanarkshire had both Fe-1 and FCal requested.

Precision

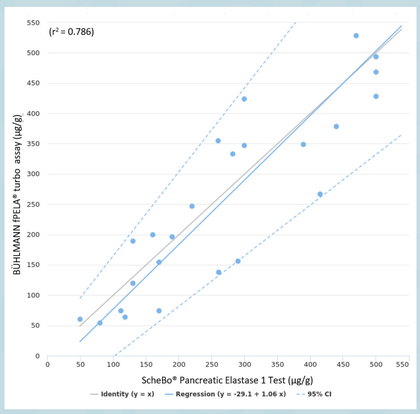
The BÜHLMANN fPELA assay showed acceptable within-lab and within-run precision, falling within an acceptable 15% as stipulated by the CLSI[5].

	Number of Replicates	Mean (µg/g)	SD (µg/g)		CV (%)	
			Interassay	Intraassay	Interassay	Intraassay
QC 1	25	153.2	3.66	3.6	2.39	2.35
QC 2	25	404.7	5.03	4.9	1.24	1.21
Patient Sample	25	421.2	6.8	5.18	1.23	1.61

Bias

The patient comparison found a slight negative bias of the BÜHLMANN fPELA assay in comparison to the ScheBo® PE1 assay, with a mean difference of -5.52% (95% CI = -18 – 6.97%). This difference was not found to be statistically significant (p = 0.242, Wilcoxon test).

The comparison with EQA showed an acceptable agreement with the ALTM (mean difference: 19.3%), other users of the BÜHLMANN fPELA assay (mean difference: 14.3%) and users of the ScheBo® PE1 assay (mean difference: 24.3%).



Interpretation of Results Between Methods

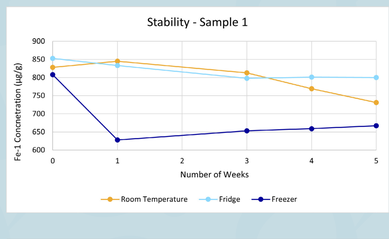
Of the 42 patients included, 36 showed complete agreement in PEI categorisation. Three patients were categorised with severe PEI using the BÜHLMANN assay and moderate PEI with the ScheBo® assay. Three patients showed disagreement in diagnosis of PEI between the methods.

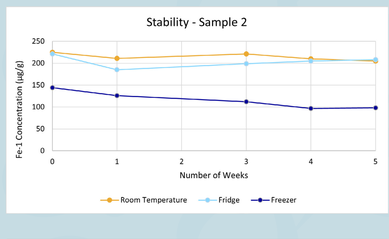
		BÜHLMANN fPELA assay		
	Fe-1 Concentration (µg/g)	< 100	100 - 200	> 200
ScheBo® PE1 Assay	< 100	4	0	0
	100 - 200	3	4	1
	> 200	0	2	28

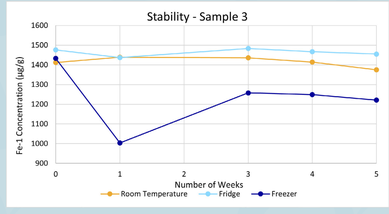
Stability

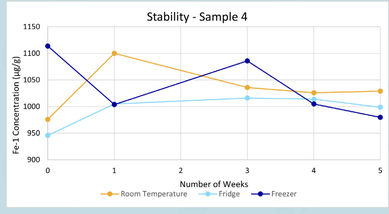
Stability of Fe-1 in CALEX® buffer surpassed manufacturer parameters at room temperature (8 days, ≤ 28°C) and 4°C (12 days), with Fe-1 concentrations of samples 1, 3 and 4 remaining within an acceptable 10% difference for 5 weeks.

Fe-1 did not appear stable when stored at -20°C following five freeze-thaw cycles, as stated by the manufacturer. Samples 1, 2 and 3 exceeded a 10% difference when stored at -20°C at all time points. Sample 4 only exceeded a difference of 10% at Week 5 when stored at -20°C.









	P-Value (Repeated Measures ANOVA)
	Temperature
Sample 1	0.002 **
Sample 2	<0.001 ***
Sample 3	0.0076 **
Sample 4	0.407

	Sample 1	Sample 2	Sample 3
	P-Value (T-Test)		
Room Temperature vs Fridge (4°C)	0.425	0.16	0.009 **
Room Temperature vs Freezer (-20°C)	0.017 **	< 0.001 ***	0.0303 *
Fridge (4°C) vs Freezer (- 20°C)	0.004 *	< 0.001 ***	0.01 *

Conclusions

The BÜHLMANN fPELA assay provides a suitable and robust alternative to the ScheBo® PE1 assay, offering advantages to the laboratory in being automated and benefiting patients served by NHS Lanarkshire, enabling the use of a single sample type, a CALEX® tube for measurement of both Fe-1 and FCal. Local implementation could improve access to the test, shorten turnaround times and reduce the environmental impact of Fe-1 measurement, by reducing both the use of disposable plastic and transportation.

References:
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